CLAIMS

We claim:

1. A homogenous anion exchange membrane prepared using a method comprising:

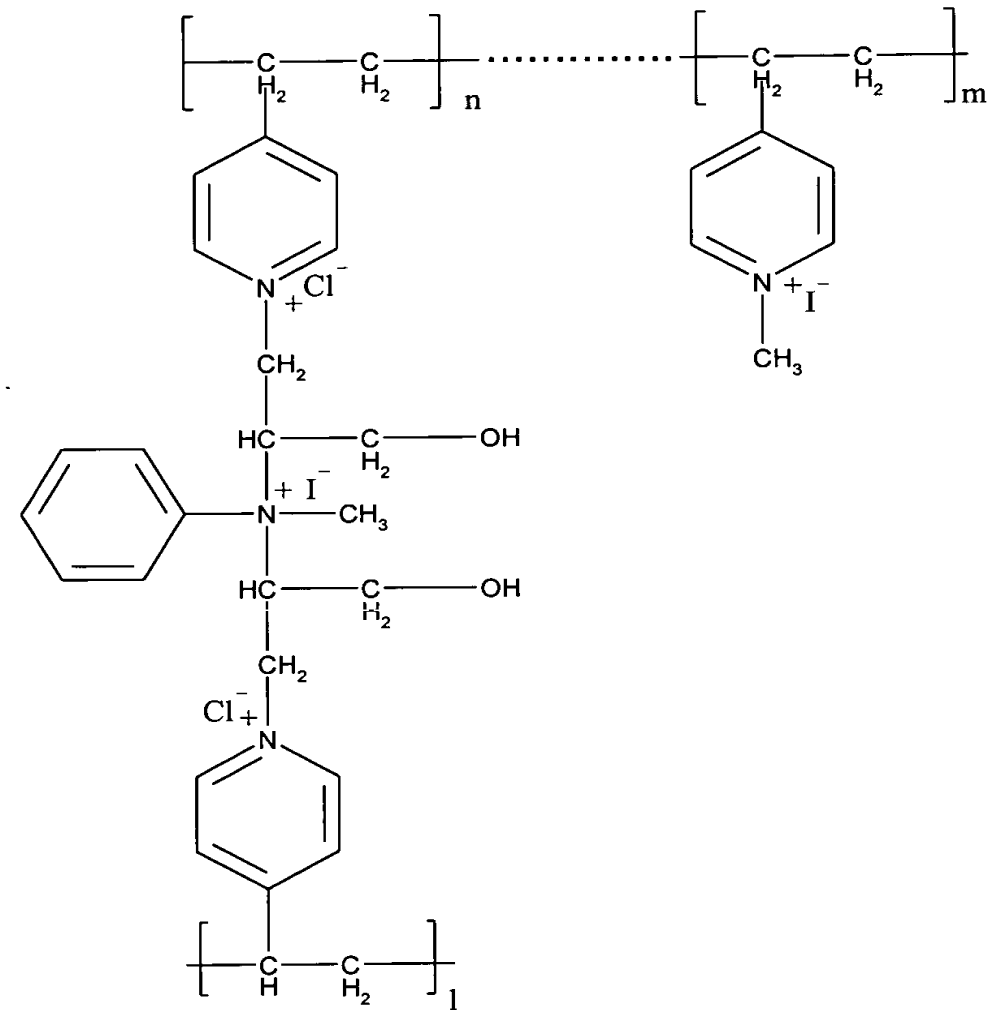
i) providing of 4-vinyl pyridine;

ii) *in situ* polymerization the 4-vinyl pyridine on a woven support membrane; and

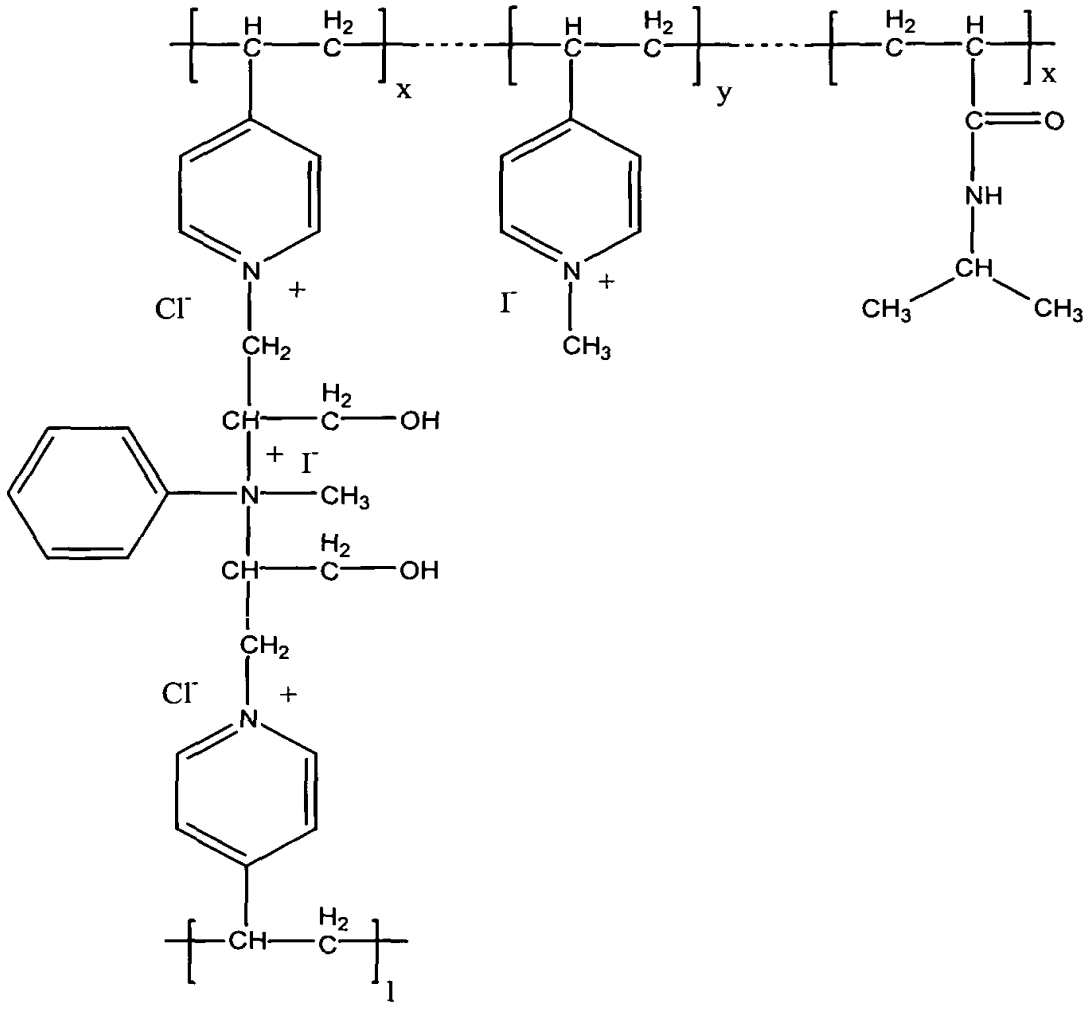
iii) *crosslinking with epichlorohydrin and aniline.*

2. The membrane of Claim 1 wherein the woven support membrane is a woven PVC membrane.

3. The membrane of Claim 1, wherein the membrane comprises a compound of the following formula:



4. The membrane of Claim 1, wherein the membrane comprises a compound of the following formula:



5. A homogenous cation exchange membrane prepared by using a method comprising:

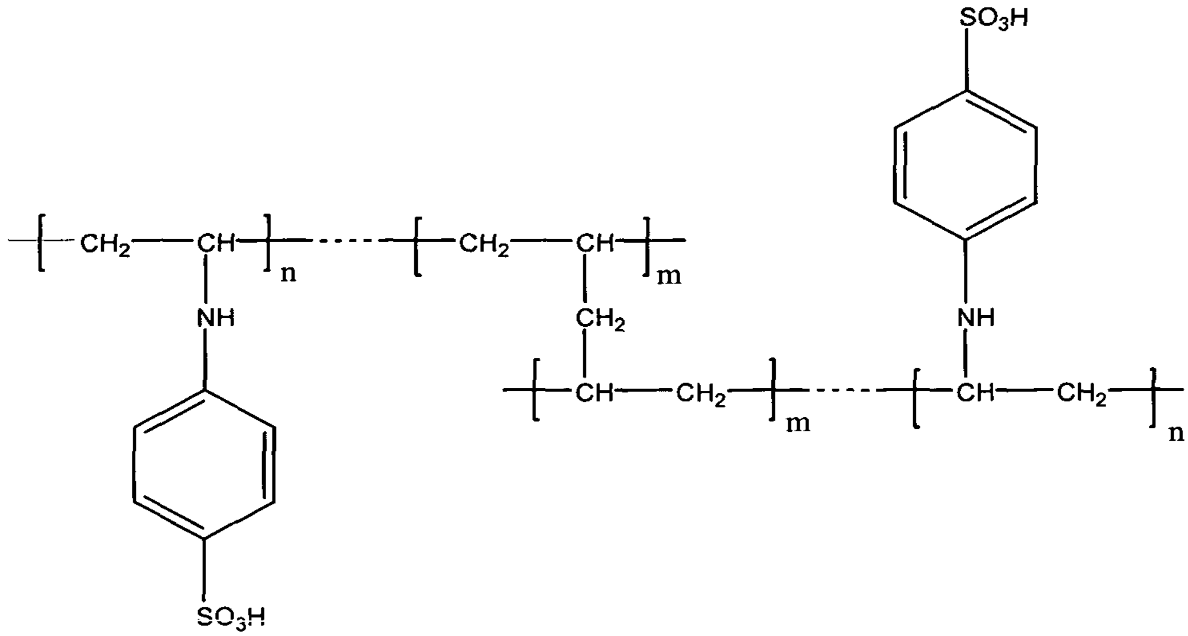
i) bromination of polyvinyl alcohol;

ii) treatment of the polyvinyl alcohol with acid to induce sulfonic acid groups;

iii) membrane formation;

iii) crosslinking using a formaldehyde solution.

6. The membrane of Claim 5, wherein the membrane comprises a compound of the following formula:



7. A process for producing an anion exchange membrane comprising *in situ* polymerization of at least one monomer, polymer or copolymer on a woven support membrane, production of a polyelectrolyte, and crosslinking of the polymers.

8. The process of claim 7, wherein the woven support membrane is a woven PVC membrane.

9. The process of claim 8, wherein polymerization of the membrane *in situ* occurs simultaneously with production of the polyelectrolyte and crosslinking of the polymers.

10. The process of claim 9 additionally comprising a later step wherein a reagent capable of forming an ion exchange group from previously unreacted chemicals of the polymer or copolymer is added.

11. The process of claim 8 wherein polymerization of the membrane *in situ* occurs simultaneously with production of the polyelectrolye, while

crosslinking occurs after membrane polymerization and polyelectrolyte production by application of a crosslinking agent to a polymerized membrane.

12. The process of claim 11 additionally comprising a later step wherein a reagent capable of forming an ion exchange group from previously unreacted chemicals of the polymer or copolymer is added.

13. The process of claim 8, wherein the ion exchange membrane produced is an anion exchange membrane comprising a positively charged organic molecule, a quaternary ammonium group, or another alkaline group.

14. The process of claim 13, wherein at least one monomer, polymer or copolymer is an aromatic nitrogen-containing monomer, polymer and/or co polymer containing one or more tertiary amine groups.

15. The process of claim 14, wherein the tertiary amine group or groups are quaternized to produce a quaternary ammonium anion exchange group.

16. The process of claim 15, wherein the membrane after polymerization and crosslinking is subjected to a quaternizing agent.

17. The process of claim 16, wherein the quaternizing agent is an alkyl halide selected from the group consisting of methyl chloride, methyl iodide, methyl bromide, ethyl chloride, ethyl iodide, ethyl bromide, propyl chloride, propyl iodide and propyl bromide.

18. The process of claim 17, wherein the quaternizing agent is methyl iodide in a hexane solvent.

19. The process of claim 18, wherein at least one monomer is selected from the group consisting of tertiary substituted acrylamides,

methylacrylate esters, methylacrylamides, acrylate esters and alkyl-substituted tertiary amine groups.

20. The process of claim 19, wherein a polymer or copolymer comprises 4-vinylpyridine polymer, a monomer comprises an aliphatic epichlorohydrin, and the crosslinking agent comprises aniline.

21. The process of claim 20, wherein the molar ratio of 4-vinyl pyridine:epichlorihydrin:aniline is 1:1:0.5.

22. The process of claim 20, wherein the molar ratio of 4-vinyl pyridine:epichlorihydrin:aniline is 1:0.5:0.25.

23. The process of claim 20, wherein the molar ratio of 4-vinyl pyridine:epichlorihydrin:aniline is 1:1:0.05.

24. The process of claim 14, wherein a copolymer comprises 4-vinylpyridine and another copolymer comprises *N*-isopropylacrylamide, a monomer comprises an aliphatic epichlorohydrin monomer, the crosslinking agent comprises aniline, and polymerization is initiated using benzyl peroxide.

25. A process for producing a cation exchange membrane comprising:

i) brominating a polyvinyl alcohol;

ii) treating the brominated poylvinyl alcohol with an acid to introduce sulfonic acid groups;

iii) forming a membrane from the treated, brominated polyvinyl alcohol; and

iv) crosslinking the membrane.

26. The process of claim 25, wherein the polyvinyl alcohol in brominated in a brominating mixture comprising 0.5N bromine in acetic acid.

27. The process of claim 25, wherein the acid used to introduce sulfonic acid groups is sulfanylic acid.

28. The process of claim 27, wherein the sulfanylic acid is a 25% solution of sulfanylic acid.

29. The process of claim 25, wherein crosslinking is obtained by treatment of the membrane with formaldehyde in concentrated sulfuric acid.

30. A process for electrodialysis comprising providing a solution comprising ions to be removed, passing the solution through a membrane stack of alternating anion exchange membranes of claim 1 and cation exchange membranes of claim 5 while applying a current orthogonal to the membrane surfaces, and withdrawing purified or concentrated solution from alternating compartments of the membrane stack.

31. The process of claim 30 wherein the solution is an aqueous industrial effluent.

32. The process of claim 30 wherein the solution is a naturally occurring aqueous solution.

33. The process of claim 32, wherein the solution is brackish water or seawater.

34. The process of claim 32, wherein the brackish water or seawater is not treated to remove excess ions prior to electrodialysis.